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THE PULLEY METHOD

OF

ADVANCING THE RECTUS,

WITH

Indications for Its Employment.

BY

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Advancement of the Recti and Indications for Its Employment.

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The preparation of this article is prompted by the conviction that the importance and success attending the operations for advancement of the recti muscles are incorrectly estimated, patients being subjected to repeated tenotomies for convergent squint, when an advancement of the opposing externus would have at once corrected the defect.

This conviction is further strengthened by the acknowledgment of several members of the 9th International Medical Congress, that the correction of the strabismus is not yet a satisfactory operation. Want of confidence in the surgical treatment of strabismus is still further shown by the willingness of many oculists to be satisfied with a partial correction, and by the not uncommon maxim that it is better to leave a slight internal squint, than to risk getting an over correction. Another maxim, which I believe arises from the lack of confidence in former operations for advancement, is, that but one eye should be corrected at a time. This is but the natural corollary of the assumed danger of over-correction.

It is my belief that if the operation of advancement of the rectus were more studied and oftener practiced, according to the indications which will follow, less apprehension would attend an over-correction than an under-correction, for in the latter event it is found the simplest matter to insert a limiting advancement suture at the time of the operation, which will advance the divided tendon with mechanical precision; whereas, to increase the effect of a tenotomy for internal squint by the further laceration of the capsule, is inaccurate

and often directly harmful, for even when successful in restoring parallelism, it does so at the expense of the power of lateral motion, and is at times productive of asthenopia, and at others followed by subsequent divergence.

The same objections hold against the insertion of a suture to increase the retraction of a tenotomized muscle beyond that which is effected by the natural contractility of the muscle itself. The effect of this measure can never be calculated, and is, fortunately, too seldom efficient to be often practiced.

In conformity with the principles of mechanics, surgery, and common sense, when the internal rectus has been tenotomized and caused to retract to the limit permitted by the capsule, the efficiency of the opposing muscle should be increased by shortening or attaching it at a more anterior point, thus equalizing the relative lateral power of both recti, and thus reinstating, rather than disturbing, the normal condition.

The tardiness with which the operation of advancement has been accorded the position of importance which it deserves, as the frequent accompaniment of tenotomy and the reliance in every case of extreme deviation, is largely due to the insecurity and inaccuracy attending the early forms of operation, as well as those which have been offered since its original conception by Gurin, in 1849.

The principal defects of all these operations are regarded by the author as depending on one of two causes: 1°. The manner of suturing the muscle: 2°. The manner of attaching the muscle to the ball.

The anatomical reasons for this are evident, viz:

1°. The fibres of the rectus muscle are held together by a very frail connective tissue which permits them to be separated by a small force. The threads which are inserted through the muscle near its cut end, have a great splitting power, met by no corresponding resistance on the part of the inter-fibrillary tissue and theca, and since the retracting power of the muscle is very considerable, there is always danger that it will escape from a suture so placed, and retract to such an extent as to cause the loss of power over the globe.

2°. The second anatomical defect is found in the feeble resisting power of the conjunctiva, which is the medium, usually employed, of attachment to the eye-ball.

Though this tissue is freely supplied with bloodvessels, its resistance to the cutting tendency of sutures is comparatively slight, hence it is observed, that, while in the main the sutures do not cut entirely out, yet there is more or less retraction of the muscle advanced, often resulting in a partial or complete failure.

Whenever two or more independent sutures are employed to attach the muscle to the globe, the loosening or tightening of all of them would be required to change the effect, if it should be found too little or too great after the muscles have recovered the normal motive power, which is usually somewhat impaired by the manipulative violence. It has, moreover, not infrequently happened, in tightening the sutures, when only two were used, that the tendon, or divided end of the rectus would be displaced above or below the plane of its physiological activity, causing an upward or downward deviation of the optical axis.

The operation of the author appeared originally in this JOURNAL, June, 1881, and in a modified and improved form in the *N. Y. Medical Record*, Aug. 8, 1885, and further simplified and perfected in the following text of the *British Ophthalmic Review*, Sept., 1887.

"In devising this operation the three points aimed at have been:

(1.) To secure an unyielding anterior fixation point by utilizing the dense episcleral tissue.

(2.) To avoid the danger of splitting the theca and consequent escape of the muscle, by the formation of a loop suture enclosing the middle portion of the rectus together with a corresponding width of capsule and conjunctiva, the cutting tendency of which should be reduced to a minimum by being made transverse to the direction of the muscular fibres; and

(3.) The formation of a knot, which, while avoiding the danger of vertical displacement, would secure precision in the maximum as well as the minimum degrees of deviation and insufficiency, and at the same time be subject to modification after the recovery from chloroform or the paresis which attends manipulation.

OPERATION.

Preliminary Tenotomy.—In high degrees of deviation, tenotomy of the opposite rectus is made for the double purpose of increasing the effect, as well as that of equalizing, on the

two sides, the cicatrization, thus preventing consequent deviation.

Pulley Suture.—Fig. 1, *a*. The eye being fixed, the anchor or pulley suture *a*, is introduced slightly into the dense tissue, one millimetre from the corneal margin[1], with a very sharp slender curved eye-needle.—(No. 25, Tiemann, N. Y.)

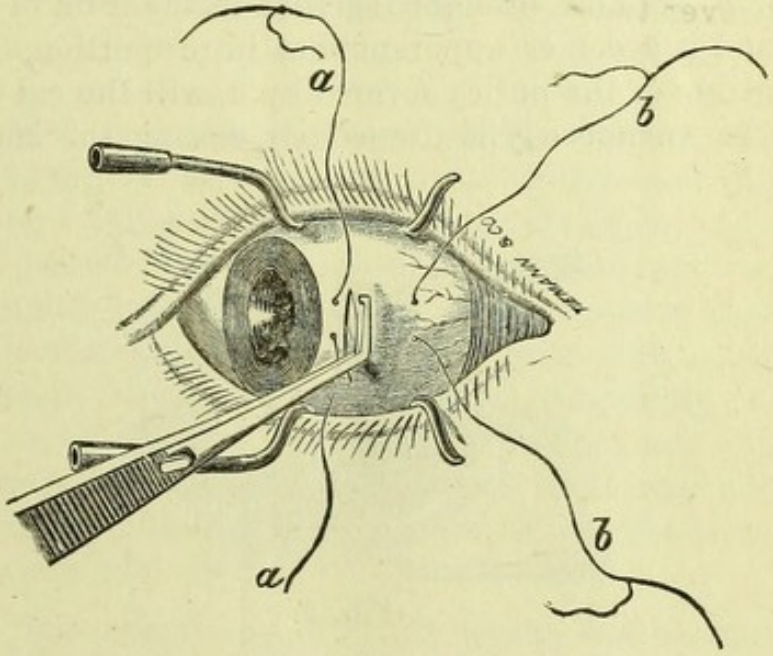

FIG. 1.

Separation of the Tendon.—The conjunctiva and capsule of Tenon having been divided, one branch of the advancement forceps (Fig. 4) is introduced underneath the tendon of the rectus, and the other closed upon it, securing the edge of the retracted conjunctiva, after which the tendon is separated from the sclera.

Loop Suture.—Fig. 1, *b*. Each end of a thread being armed with a needle, both are passed from beneath the elevated rectus, through the capsule, muscle and conjunctiva, enclosing the middle portion of the rectus in a loop, from which it cannot escape. The tissues in the grasp of the forceps are now divided two millimetres anterior to the loop suture, the location of which will depend on the amount of advancement required in each individual case.

In the absence of an efficient advancement forceps, this suture may be introduced by opening the conjunctiva and

1.—Since the publication of this operation information has been obtained that Gurin originally employed the scleral attachment, but it has been thought dangerous by most subsequent surgeons, and the uncertain attachment to the conjunctiva preferred, for reasons which do not exist since the introduction of aseptic methods. The scleral suture is endorsed by H. Knapp, who has employed it for many years to increase the effect of a tenotomy.

capsule parallel with the margin of the rectus, elevating the muscle on a strabismus hook, and suturing it together with the capsule and conjunctiva before separating the tendon.

Advancement.—Fig. 2. One end of suture *b* is crossed over suture *a*, both ends of which are now brought together and securely tied, enclosing the former in a loop or *pulley*. Both ends of *b* are now brought together in the form of a surgical knot, and it becomes apparent that in proportion as they are tightened over the pulley formed by *a*, will the cut end of the rectus be advanced, simultaneously closing the conjunctival gap.

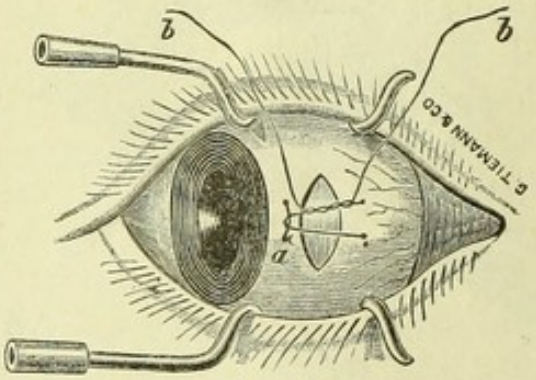

Fig. 2.

To obtain the most perfect correction, a bow-knot is tied, or the threads twisted together to prevent slipping, and time allowed for recovery from the effect of traction, which should, as much as possible, be avoided during the operation. After this, the knot may be secured, or the effect increased or diminished as conditions may indicate.

Quite the same effect may be obtained by reversing the order of the sutures and making the scleral attachment with the needle at one end of suture *b*, in which case the pulley will be formed by the bridge of dense scleral tissue. (Fig. 3.)

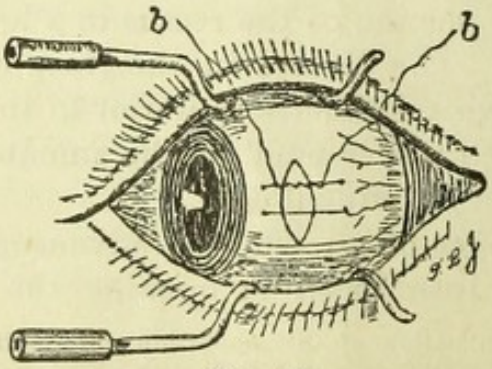

Fig. 3.

This plan has been adopted in some of my later operations

and is thus preferred in St. George's Hospital, London, and in some of the German hospitals where it has been adopted.

Limiting Tenotomy.—The conception of a sliding suture, enabling the operator to regulate the effect to any desired

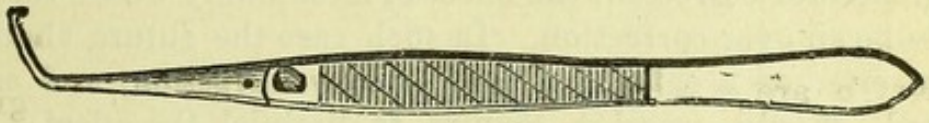

FIG. 4.

FIG. 5.

degree, removes much of the uncertainty attending tenotomies in cases of insufficiency and diplopia. There being no cause for ex-section, a curved needle is passed into and out of the tendon, subsequently dipping into the sclerotic in the reverse direction, thus forming sutures *b* and *a* with one continuous thread. The tendon is then completely divided without anxiety from over-correction, for, should it occur, the surgeon has but to limit the effect by tightening the suture when the tendon is advanced as may be required.

The remaining difficulty which has been experienced in these operations is the recovery of a muscle retracted from a previous operation. To accomplish this a curved needle (Fig. 5) has been devised, which will be found useful in various operations on the conjunctiva. It has a short spiral curve with an eye in the point, through which the thread passes after leaving the spool, and as now made by Tiemann, New York, and Weiss, London, it will fit into any eye case and may be always threaded and ready for use."

INDICATIONS.

The following indications for the employment of advancement have stood the test of observation and experience since their original publication in the SAINT LOUIS MEDICAL AND SURGICAL JOURNAL June, 1881. They are conveniently classified in the following groups:

1°. In the correction of binocular diplopia, the ease and accuracy with which the effect can be increased or

diminished render this method of advancement especially available.

2°. In case of convergent strabismus, measuring by Landolt's method[2] less than 15°, ametropia having been eliminated or corrected, the effect of a tenotomy would sometimes be an over-correction. In such case the suture should be inserted as a safeguard against over-correction, and employed, should occasion require, to diminish the effect.

3°. In case of internal squint exceeding 15°, in which from any cause the operation is confined to one eye, a simple tenotomy of the internal rectus will seldom secure a constant correction. In such case an increase of the effect is best obtained by a requisite advancement of the externus.

4°. The same rule applies to an inward deviation exceeding 30°. A simple tenotomy of both interni without excessive laceration of the capsule will seldom suffice. In such case an advancement of one or both external recti will usually be required to effect an enduring parallelism.

5°. In case of external squint exceeding 10°, a simple division of both attachments of one external rectus will seldom effect parallelism, and as convergence is usually impaired a requisite advancement of the internus is to be made. When each eye diverges, exceeding 10°, a double internal advancement is indicated.

6°. In case of divergent squint, (the previous condition having been convergence,) following tenotomy, H. not having been corrected; or from excessive laceration of the capsule allowing the tendon to recede back of the equator; or from accidental myotomy—an advancement of the retracted muscle is imperative. If of long standing, its efficiency will be impaired and a tenotomy of the opposing externus will be required. When the muscle cannot be secured, a myotomy or an exsection of the anterior end of the externus will equalize the inefficiency and restore parallelism, and besides secure from 20° to 45° of lateral motion, through the action of the retracted muscles on the capsule of Tenon or the orbital cellular tissues. This has been observed in six cases.

In these latter cases the suture is placed in the nasal extension of the capsule of Tenon or plica semi-lunaris which is attached to this portion of the capsule.

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2. "Manual of Examination of the Eyes," Landolt, p. 49, Ed. 1879. "Traité d'Ophthalmologie," Landolt, and Wecker, Vol. I, p. 915. Bestimmung des Schielens. Snellem u. Landolt. Handbuch der Augenheilkunde. Graefe und Saemisch, Vol. III, p. 235.